ENANTIOMER-SELECTIVE POPULATION TRANSFER EXPERIMENTS IN THE MICROWAVE REGIME: FROM MEASURING TO CONTROLLING CHIRALITY

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Over the last few years, microwave three-wave mixing (M3WM) experiments have emerged as a sensitive tool to measure enantiomer-specific molecular signals in the microwave regime.[a,b] Control over the relative phases and polarizations of applied excitation pulses provides a way to selectively populate or depopulate a particular rotational state to create an enatiomeric enrichment through selective population transfer.[c,d] This approach has been demostrated in systems with a stereogenic center, where the two enantiomers are separated by an infinitly high barrier. In this talk, we will present succesful population transfer experiments on systems that do not have a stereogenic center but may become chiral due to their three-dimensional arrangement upon cooling, such as chiral conformers.[e] In these kinds of systems, the enantiomeric pair is separated by an relatively high barrier that cannot be overcome to enable interconversion on the timescale of the experiment. When the barrier is lowered further, quantum tunneling is usually observed in the microwave spectrum. We will show that it is possible to perform M3WM and population enrichment experiments in this kind of systems. The experimental implementation will be presented and discussed.

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[c] Eibenberger, S.; Doyle, J.; Patterson, D. Enantiomer-Specific State Transfer of Chiral Molecules. Phys. Rev. Lett. 2017, 118, 123002.

[d] Perez, C.; Steber, A. L.; Domingos, S. R.; Krin, A.; Schmitz, D.; Schnell, M. Coherent Enantiomer-Selective Population Enrichment Using Tailored Microwave Fields. Angew. Chem. Int. Ed. 2017, 56, 12512–12517.

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